

REMARKS

In the Office Action mailed June 4, 2007, the Examiner rejected claims 1-7. In this response, claims 1, 3 and 4 have been amended to more clearly define the invention and claim 7 has been canceled. The amendments are supported by the specification. For example, the amendments to claims 1 and 3 are supported by FIG. 2 and FIG. 3 and the corresponding description at pages 9-11 in the specification. No new matter is added by this response. After entry of this paper, claims 1-6 remain pending in this application. Applicants respectfully traverse the rejections and request reconsideration in view of the amendments and following remarks.

Claim Objections

Claim 4 has been amended to overcome the objection helpfully noted by the Examiner.

Claim Rejections under 35 U.S.C. §102(e)

Claims 1 and 3 and their dependent claims 2, 4-6 have been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 7,155,316 to Sutherland et al ("Sutherland"). Applicants respectfully disagree with the Examiner's assertion.

The amended claims 1 and 3 require a virtual safety barrier inside a physical safety barrier which is provided around the robot. In operation, a working region ("margin region") can be formed between the virtual safety barrier and the physical safety barrier. The movable portions of the robot are controlled within the virtual safety barrier so that the workers can safely operate in the formed margin region.

In conventional robot control systems, controls are typically based on whether there is an interference between a moving portion of the robot and the physical safety barrier. If a worker operates inside the physical safety barrier as the robot operates, the worker is exposed to the risk of being caught by the robot.

Sutherland is directed to a robot system including two movable arms for use in cranial trepanation surgery. Virtual "no-go" boundaries are defined for the two movable arms so as to prevent injury to the patient's neural system during surgery. Similarly to the conventional robot control technologies as discussed above, Sutherland discloses using only one layer of safety barrier, i.e., the virtual "no-go" boundary. Sutherland fails to teach "constructing a physical safety barrier around a movable robot" or "defining ... a virtual safety barrier ..., the virtual safety barrier being set inside the physical safety barrier."

Moreover, claim 1 recites "... braking of the arm at a predetermined distance ahead of the virtual safety barrier ... if it is determined that any one of the three-dimensional spatial regions ... will come into contact with said virtual safety barrier." Independent claim 3 recites a similar limitation. Using the three dimensional spatial regions helps to start to brake the robot arms ahead of time. Sutherland just discloses that virtual "no-go" boundaries can be defined so as to prevent injury to the patient's neural system during surgery. Sutherland fails to disclose how the "no-go" boundaries are defined or how to prevent the arms from entering the "no-go" boundaries. Sutherland also fails to teach or disclose "defining at least two three-dimensional spatial regions including parts of the arm of the robot including said work or tool" or "... braking of the arm at a predetermined distance ahead of the virtual safety barrier ... if it is

determined that any one of the three-dimensional spatial regions ... will come into contact with said virtual safety barrier," as required in claims 1 and 3. Therefore, independent claims 1 and 3 are allowable over Sutherland.

Claims 2 and 4-6 are ultimately dependent upon claim 1 or claim 3; and thus, claims 2 and 4-6 are patentable for at least the same reasons as set forth above in connection with independent claims 1 and 3.

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully request reconsideration and reexamination of this application and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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